

## PATENT ABSTRACTS OF JAPAN

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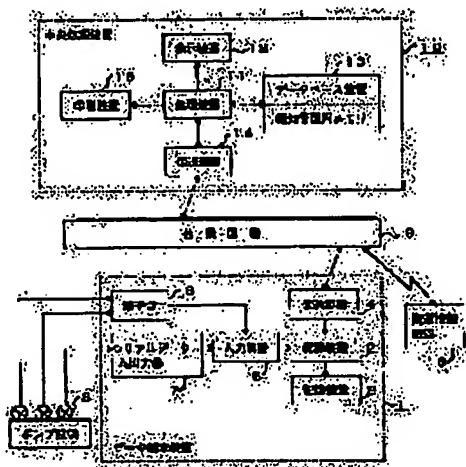
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## (54) PUMP YARD REMOTE MONITORING SYSTEM

## (57) Abstract:

**PROBLEM TO BE SOLVED:** To provide a pump yard remote monitoring system that can reduce the data transmission cost and also can quickly deal with the abnormality.

**SOLUTION:** A data terminal equipment 1 placed at a pump yard fetches the data showing the operating conditions of the water level, etc., of the pump yard and the operating state of the pumping facilities via an input device 5 and stores these data in a storage 3. Then, the necessary data are transmitted via a transmitting device 4, a public circuit 9 and a transmitting device 14 only when a failure signal is included in those fetched data, an arithmetic unit 2 processes the input data and recognizes the abnormality or a transmission request is received from a CPU 10. When the data having abnormality are received, the CPU 10 refers to a data base device 13 storing the telephone number, etc., of a person in charge and notifies the abnormality via an automatic calling operation to quickly deal with the abnormality.



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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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## FULL CONTENTS

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**[Claim(s)]**

[Claim 1] in the pump machine place remote monitoring system which consists of data terminal equipment installed for every pump machine place, and center equipment connected through each and the communication line of the data terminal equipment The 1st data collection means for each of said data terminal equipment to collect and hold the operation condition data containing the water level of the pump machine place concerned, The 2nd data collection means for collecting and holding the operational status data of equipment of the pump machine place concerned, The malfunction detection means for detecting this, when abnormalities are in the data collected by the transmitting means for transmitting data to said center equipment, and the said 1st and 2nd data collection means, The control means for controlling to transmit the data in which collection maintenance was carried out by the said 1st and 2nd data collection means to said center equipment through said transmitting means, when abnormalities are detected by this means, or only when the request-to-send signal has been sent from said center equipment, The pump machine place remote monitoring system characterized by preparation \*\*\*\*\*.

[Claim 2] While having a heavy fault detection means by which said malfunction detection means considered as the input the object data with which it was beforehand set of the data in which collection maintenance was carried out by said 2nd data collection means, and the heavy fault range of detection for this every object data was set as the interior When this means judges that at least one of said object data is contained in said heavy fault range of detection concerned corresponding to data, and heavy fault occurred, Or when the signal which shows heavy fault to the inside of the data collected by said 2nd data collection means is included, [ said control means ] The pump machine place remote monitoring system according to claim 1 characterized by collecting the data by which collection maintenance was carried out between the times of going back from this time by the said 1st and 2nd data collection means till predetermined time, and transmitting to said center equipment.

[Claim 3] While having a light fault detection means by which said malfunction detection means considered as the input the object data with which it was

beforehand set of the data in which collection maintenance was carried out by said 2nd data collection means, and the light fault range of detection for this every object data was set as the interior When this means judges that at least one of said object data is contained in said light fault range of detection concerned corresponding to data, and light fault occurred, Or when the signal which shows light fault to the inside of the data collected by said 2nd data collection means is included, [ said control means ] The pump machine place remote monitoring system according to claim 1 characterized by collecting the data then collected by the said 1st and 2nd data collection means, and transmitting to said center equipment.

[Claim 4] It is the pump machine place remote monitoring system according to claim 2 or 3 characterized by said center equipment having the function which can be set up through a communication line for said heavy fault range of detection or light fault range of detection to said heavy fault detection means or a light fault detection means.

[Claim 5] Said center equipment is a pump machine place remote monitoring system according to claim 1 characterized by having the function which transmits said request-to-send signal to said data terminal equipment at the time in which it was provided once beforehand at least on the 1st.

[Claim 6] The person-in-charge database with which said center equipment stored at least one of the telephone number of a remote monitoring person in charge or the organization in charge, a pager call number, and the facsimile numbers, The information means for performing automatic call origination with reference to said person-in-charge database, and reporting an abrupt increase, when data has been transmitted with the urgent abrupt increase defined beforehand from said data terminal equipment, The pump machine place remote monitoring system according to claim 1 characterized by having a response means for returning the data which received the inquiry from said person in charge or the organization in charge, and was asked to the information of the abrupt increase by this means.

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#### [Detailed Description of the Invention]

##### [0001]

[Field of the Invention] Especially this invention relates to the pump machine place remote monitoring system for performing intensively and efficiently operation condition management and failure correspondence of a pump machine place in a maker or a maintenance company about a pump machine place remote monitoring system.

##### [0002]

[Description of the Prior Art] [ the telemeter equipment 25 which drawing 2 is the block diagram showing the outline composition of the conventional remote monitoring system, and was installed in the pump machine place 21 ] The signal about water level, operation, failure of equipment, etc. is taken in through the input unit 201. A programmable logic controller (PLC) 202 performs scale conversion processing etc., and it changes into the signal for transmission, and

transmits to the monitoring center installed far away through the transmission equipment 203 and the communication line 22. In a monitoring center, it receives through the telemeter equipment 23 which consists of a programmable logic controller 232 which performs the transmission equipment 231, data-conversion processing, etc., it processes with the supervisory equipment 24 which consists of a processor, a display device, a printer, etc., and the transmitted signal is displayed on a watch stander. Such conventionally, in a system, from a pump machine place, data is always transmitted irrespective of the normality of opportunity place equipment, abnormalities or the safe value of measurement data, and a watch value, and a watch stander performs continuous monitoring fundamentally. And in order to always perform data transmission from a pump machine place, in almost all cases, the leased circuit is applied as a communication line.

[0003] JP,H8-33883,A is mentioned as a well-known example of a system which was described above. This well-known technology is a system which performs remote monitoring by transmitting the data about two or more operation conditions and troubleshooting of sewage treatment equipment to a center information processor through a public circuit or a leased circuit.

[0004]

[Problem to be solved by the invention] In the above-mentioned conventional remote monitoring system, since the leased circuit was used in order continuous monitoring is needed in supervisory-equipment since data is always transmitted irrespective of the tendency of the normality of opportunity place equipment, abnormalities, or measurement data, and to always perform data transmission, there was a problem of becoming a cost overrun. Moreover, even if supervisory equipment is installed in the office or government office which generalizes a pump machine place in many cases and the alarm of the failure is carried out, since grasp of an exact failure content and judgment of measures are difficult. The present condition was connecting generating of failure to a pump maker or a maintenance company by the telephone or other means, and coping with it by an engineer going to an opportunity place from the maker or maintenance company which received the connection. For this reason, there was a problem of taking time further before a failure condition cannot grasp correctly but will implement a suitable measure in a maker or a maintenance company if delay arises for the time which connection etc. takes and a defect is in the contents of connection by the time it actually performs the measure against failure, after a failure alarm alerts. Furthermore, it is after failure generates the signal about the failure transmitted from a pump machine place, and catching the signs of failure in advance and transmitting a failure forecast signal to supervisory equipment was called for.

[0005] The purpose of this invention is low cost and there is in offering the possible pump machine place remote monitoring system of being able to ease a watch stander's burden, and receiving unusually [ failure etc. ], and corresponding promptly.

[0006]

[Means for solving problem] The data terminal equipment in which this invention

was installed for every pump machine place in order to attain the above-mentioned purpose, [ each of said data terminal equipment ] in the pump machine place remote monitoring system which consists of center equipment connected through each and the communication line of the data terminal equipment The 1st data collection means for collecting and holding the operation condition data containing the water level of the pump machine place concerned, The 2nd data collection means for collecting and holding the operational status data of equipment of the pump machine place concerned, The malfunction detection means for detecting this, when abnormalities are in the data collected by the transmitting means for transmitting data to said center equipment, and the said 1st and 2nd data collection means, The control means for controlling to transmit the data in which collection maintenance was carried out by the said 1st and 2nd data collection means to said center equipment through said transmitting means, when abnormalities are detected by this means, or only when the request-to-send signal has been sent from said center equipment, The pump machine place remote monitoring system characterized by preparation \*\*\*\*\* is indicated.

[0007] Moreover, this invention considers as an input the object data with which it was beforehand set of the data with which collection maintenance of said malfunction detection means was carried out by said 2nd data collection means. While having a heavy fault detection means by which the heavy fault range of detection for this every object data was set as the interior When this means judges that at least one of said object data is contained in said heavy fault range of detection concerned corresponding to data, and heavy fault occurred, Or when the signal which shows heavy fault to the inside of the data collected by said 2nd data collection means is included, [ said control means ] The pump machine place remote monitoring system characterized by collecting the data by which collection maintenance was carried out between the times of going back from this time by the said 1st and 2nd data collection means till predetermined time, and transmitting to said center equipment is indicated.

[0008] Moreover, this invention considers as an input the object data with which it was beforehand set of the data with which collection maintenance of said malfunction detection means was carried out by said 2nd data collection means. While having a light fault detection means by which the light fault range of detection for this every object data was set as the interior When this means judges that at least one of said object data is contained in said light fault range of detection concerned corresponding to data, and light fault occurred, Or when the signal which shows light fault to the inside of the data collected by said 2nd data collection means is included, [ said control means ] The pump machine place remote monitoring system characterized by collecting the data then collected by the said 1st and 2nd data collection means, and transmitting to said center equipment is indicated.

[0009] Moreover, the pump machine place remote monitoring system characterized by for this invention having minded said heavy fault range of detection or light fault range of detection to said heavy fault detection means or the light fault detection means, and for said center equipment having minded the

communication line, and having the function which can be set up is indicated. [0010] Moreover, this invention indicates the pump machine place remote monitoring system characterized by having the function in which said center equipment transmits said request-to-send signal to said data terminal equipment at the time in which it was provided once beforehand at least on the 1st. [0011] Furthermore, the person-in-charge database with which, as for this invention, said center equipment stored at least one of the telephone number of a remote monitoring person in charge or the organization in charge, a pager call number, and the facsimile numbers, The information means for performing automatic call origination with reference to said person-in-charge database, and reporting an abrupt increase, when data has been transmitted with the urgent abrupt increase defined beforehand from said data terminal equipment, The pump machine place remote monitoring system characterized by having a response means for returning the data which received the inquiry from said person in charge or the organization in charge, and was asked to the information of the abrupt increase by this means is indicated.

[0012]

[The example of a form of implementation of invention] The form of operation of this invention is explained hereafter. Drawing 1 is the block diagram showing the example of the pump machine place remote monitoring structure of a system which becomes this invention. It is installed in a pump machine place by the data terminal equipment 1, and Operation of main device equipment required for a pump and its operation, Information, including the water level in failure information and a pump machine place etc., is taken in from the input unit 5, various kinds of operations according to the control program beforehand set up with the arithmetic unit 2 and the storage to the storage 3 are performed, and signal transformation for transmitting the result with the public circuit 9 in the transmission equipment 4 is performed. In the arithmetic and program control 10, receive the signal transmitted from the data terminal equipment 1 through the public circuit 9, and the transmission equipment 14 performs data conversion, and [ the processor 11 ] According to the control program set up beforehand, the data storage to database equipment 13, the display to the display device 12, the output (printing) to the printer 15, etc. are processed.

[0013] The prime mover which needs the input unit 15 of the data terminal equipment 1 for a pump and its operation, It takes in from the equipment which was [ direct picking ] crowded in information, including the water level in the operation information on main device equipment of reduction gears etc., failure information, the Measurement Division information, and a pump machine place etc., through the terminal stand 6 from the sensor 8, or has already taken in these information indirectly through the serial data I/O machine 7. This portion serves as composition according to the pump machine place in which the data terminal equipment 1 is installed. The public circuit 9 is the general subscriber telephone line (analog) or the ISDN subscriber's loop (digital), and only when data transmission is required, the data terminal equipment 1 and the arithmetic and program control 10 are connected. In the case of a modem and an ISDN circuit, the transmission equipment 4 and 14 consists of terminal adapters, when

using the telephone line as a public circuit 9.

[0014] the arithmetic unit 2 processes the inputted variety of information in the above-mentioned composition besides the scale conversion of the signal in the case of using the terminal stand 6. First, about the information about the commencement of commercial operation of main device equipment required for the pump and its operation of the information taken in through the input unit 5, and a halt, when states, such as commencement of commercial operation and a halt, occur, the information is stored in the storage 3 with time. Moreover, the sample cycle, for example, the cycle of 1 second, takes in the Measurement Division information on steady events, such as rainfall and water level, and it stores in the storage 3 with the time entry currently held within a self-arithmetic unit. Moreover, the arithmetic and program control 10 sends a data request signal to the data terminal equipment 1 at the time set once on the 1st, for example. On the other hand, the arithmetic unit 2 creates the history information summarized for every hour of steady information, including operation of main device equipment required for the pump for [ which has been memorized ] one day, and its operation, the history information on a halt and rainfall, water level, etc., from the data of the storage 3, and transmits these to the arithmetic and program control 10.

[0015] Furthermore, the arithmetic unit 2 performs fault detection processing of equipment of a pump etc. This fault detection may be detected from the Measurement Division signal about main device equipment required for [ else / in case the direct input of the failure signal is carried out through the input unit 5 ] a pump and its operation. As a method of detecting from the Measurement Division signal, as shown, for example in drawing 3, two fiducial points X1 and X2 ( $X1 < X2$ ) are set up to the target measured magnitude, and this and measured magnitude are measured. And if it seems that the state where measured magnitude exceeds a fiducial point X1 continues for 5 seconds, it will judge that light fault detected (forecast), and if it seems that the state of exceeding a fiducial point X2 continues for 5 seconds, it will be judged that heavy fault detected (forecast). In addition, although a failure field shall be located by  $X1 < X2$  at drawing 3 in the one where a measurement value is larger, it is also the same as when approaching failure so that  $X1 > X2$ , i.e., a measurement value, are small. Moreover, in any [ of \*\* and heavy fault ] case, observation time after exceeding a fiducial point until it judges failure was made into 5 seconds, but these may also be another time. And if a fiducial point X1, and X2 and said observation time enable a variable setup from the arithmetic and program control 10, they are convenient. The arithmetic unit 2 calls the arithmetic and program control 10 in emergency dial with the time entry which holds all the information then taken into the input unit 5 within a self-arithmetic unit, when the above-mentioned light fault is detected. Moreover, besides all the information then taken into the input unit 5 when heavy fault is detected The Measurement Division signal about main device equipment required for a pump and its operation, for example, the history for the past 120 seconds, is created from the data of the storage 3, and the arithmetic and program control 10 is called in emergency dial with the time entry currently held within a self-arithmetic unit. Drawing 4 is the example of the history

information for [ it sends out at the time of the above-mentioned heavy fault detection ] 120 seconds, and temperature, voltage, current, and the measurement value of vibration are shown as a measurement value which took in the sample cycle and was stored in storage. And the oscillating measurement value x is the case where predetermined observation time passes exceeding the fiducial point X2 (heavy fault disregard level).

[0016] Next, operation of the arithmetic and program control 10 of drawing 1 is explained. The transmission equipment 14 performs signal-transmission processing united with the classification (an analog or digital) of the public circuit as mentioned above. The processor 11 receives the history information in every hour on Measurement Division information, including operation of the device equipment which it transmits once on the 1st and it transmits a data request signal to the data terminal equipment 1, and answers this and is transmitted from data terminal equipment, the history of a halt, water level, etc. Moreover, the information about the failure detected by data terminal equipment is also received immediately after the failure generating. And the these-received information is edited in the form of predetermined, as the example was shown in drawing 5 , and the display to the display device 12 and the output to the printer 15 are performed. Moreover, an operator is provided with simple operating environment. Furthermore, as shown in drawing 6 , the information from the data terminal equipment installed in each pump machine place is built so that it can search according to items, such as an area, a use, a scale, a customer, and a generating locating fault, and storage processing to database equipment 13, output processing to the printer 15 of the data, etc. are performed.

[0017] If the arithmetic and program control explained above is installed mainly in a maker or a maintenance company, the exact grasp and the prompt action of the situation of it will be attained at the time of failure generating. Moreover, since forms control, such as a daily report and an operation history, can be performed similarly, together with failure correspondence, operation management also becomes possible and leads to improvement in service. And since this system is not performing steady data transmission, it does not need to use a leased circuit and has the advantage which there are also few transmission costs and ends.

[0018] Furthermore, although the portable information device 16 is shown, this is prepared in drawing 1 in order to be able to perform connection and correspondence in emergency more quickly. [ in the failure which needs suitable disposal although it does not lead to functional loss of a pump immediately ] when an emergency call is transmitted from data terminal equipment as mentioned above [ the processor ] while the processor 11 displays the message which tells failure generating on the display device 12 Their related post of a maker or a maintenance company its beforehand registered into the information administrative area of database equipment 13, a maker field management person's telephone number, or a pager number facsimile number is read, and automatic call origination is performed. When [ moreover, ] it is a thing about the failure which leads to functional loss of a pump The telephone number of the on-site person in charge of a government office who generalizes the pump machine place which is beforehand registered into the information administrative area of

database equipment 13 in addition to the above-mentioned contact, A pager number or a facsimile number is read, automatic call origination is performed, in the case of a telephone, it announces with voice, and, in the case of facsimile, the opportunity place name and failure content which failure has generated are announced in written form. In this way, if automatic call origination is performed, this will be received by the cellular phone during the telephone of a manager or a person in charge, FAX equipment, or movement. On the other hand, when there is an inquiry by telephone from a manager etc., operation of equipment, stop information, the present Measurement Division information on a device, the present water level information, etc. guide the information item to offer, and detailed information is offered with voice about the item which the manager chose based on this. Moreover, when there is an inquiry from a personal digital assistant etc., detailed information is offered in the menu screen of a personal digital assistant about the item chosen by the manager from operation of equipment, stop information, the Measurement Division trend information showing the temporal response of the measurement value of a device, the water level trend information showing the temporal response of water level, etc. In addition, the processor 11 performs automatic call origination in such an emergency, guidance notice, creation of detailed information, and processing of sending out etc. using well-known technology, therefore a required program, voice data, etc. assume that the processor 11 contains.

[0019]

[Effect of the Invention] As explained to details above, [ the pump machine place remote monitoring system of this invention ] The office which collects the measured information and will generalize a pump machine place through a public circuit on the 1st at the time of 1 time or failure generating, and a failure forecast, processing by transmitting to the arithmetic and program control installed in the maker or the maintenance company, and accepting necessity -- a manager -- an automatic announcement -- or since it answers, the following prominent effect is expectable.

(b) Since data transmission is limited on the first at the time of 1 time or failure generating, and a failure forecast, laborsaving of surveillance business and low cost-ization can be attained.

(b) Since a failure forecast signal is also transmitted from a pump machine place in addition to a failure generating signal, the early detection of an equipment failure becomes possible.

(Ha) By installing the arithmetic and program control for supervising also in a maker or a maintenance company, exact grasp of a failure condition and the action with prompt failure can be aimed at.

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[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the example of the pump machine place remote monitoring structure of a system which becomes this invention.

[Drawing 2] It is the block diagram showing the conventional example of the pump machine place remote monitoring structure of a system.

[Drawing 3] It is the explanatory view of the fault detection processing method in data terminal equipment.

**[Drawing 4]** It is the example of the attachment data at the time of heavy fault generating from data terminal equipment.

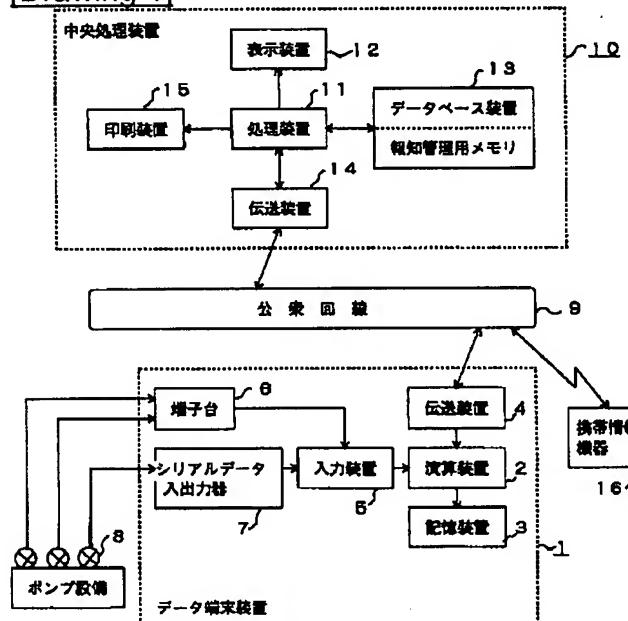
[Drawing 5] It is the example of the total data in arithmetic and program control.

[Drawing 6] It is the example of composition of a database.

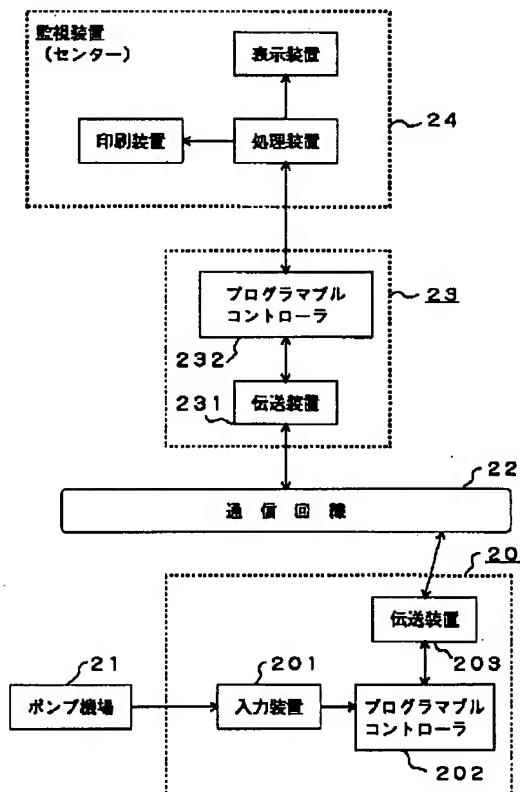
### Explanations of letters or numerals

- 1 Data Terminal Equipment
  - 2 Arithmetic Unit
  - 3 Storage
  - 4 Transmission Equipment
  - 5 Input Unit
  - 6 Terminal Stand
  - 7 Serial Data I/O Machine
  - 8 Sensor
  - 9 Communication Line (Public Circuit)
  - 10 Arithmetic and Program Control
  - 11 Processor
  - 12 Display Device
  - 13 Database Equipment
  - 14 Transmission Equipment
  - 15 Printer
  - 16 Portable Information Device

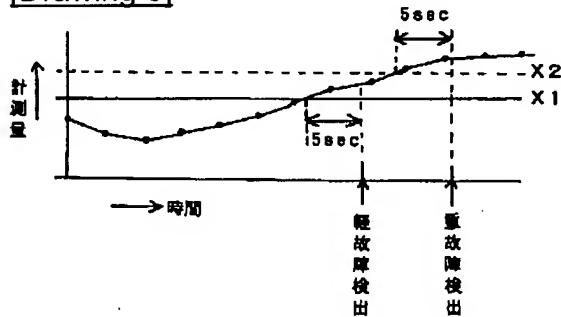
### [Drawing 1]



[Drawing 2]



[Drawing 3]



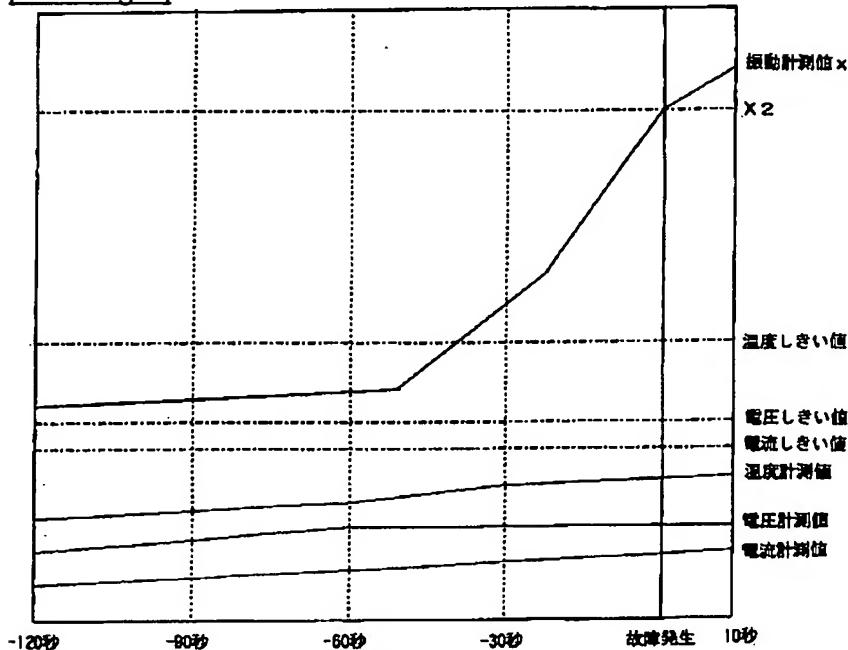
[Drawing 5]

時刻	故障項目	重/軽	状態	時刻	運転機器	状態
10:45	始動渋滞	重故障	発生	10:43	吐出ゲート	開

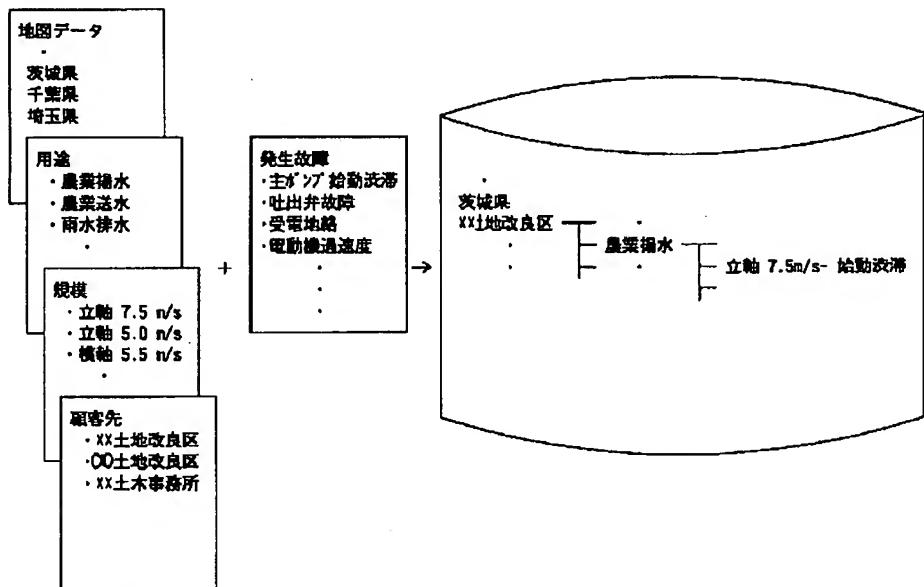
  

時刻	内水位	外水位	主ポンプ 運転時間	ポンプ 排水量	...	受電電力
1:00	X.XXm	X.XXm	XX分	X.XXm <sup>3</sup>		XXkW
2:00						
:						
24:00						
累計						
最高						
最低						
平均						

[Drawing 4]



[Drawing 6]



[Translation done.]